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Heavy-Duty Engine Testing Report
Correlation Testing of Cummins NTCC-400

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Technical Report

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By

Thomas M. Baines

October, 1986

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16. ABSTRACT

This report discusses the results of testing the Cummins NTCC-400 heavy-duty diesel engine at the Environmental Protection Agency, Motor Vehicle Emission Lab. This engine was tested for the purpose of providing correlation data to compare EPA and Cummins laboratories. Also reviewed are six fuel compositions of varying aromaticity to investigate how these parameters influence gaseous and particulate exhaust emissions.

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I. Background

EPA has performed several testing programs on Cummins engines for the purpose of providing correlation data to compare the EPA and Cummins laboratories. One such program was in June of 1985 and the engine was an NTCC-400. The engine was subsequently returned to Cummins where further testing was performed which enlarged the data base on this engine. This engine was then scheduled to be sent to Southwest Research Institute (SwRI) for inclusion in the Coordinating Research Council (CRC) VE-1 fuels study.

The SwRI/CRC study is being performed on four medium- and heavy-duty diesel engines (calibrated for 5.0 g/BHP-hr NOx) and six fuel compositions of varying aromaticity to investigate how these parameters influence gaseous and particulate exhaust emissions. This study is of special importance to EPA as it will be heavily relied upon for EPA's fuel sulfur effects information.

Work on this project was temporarily suspended by the CRC committee due to SwRI measuring HC 20 percent lower than Caterpillar on the first engine (a Caterpillar 3406 B). EPA then suggested that no further work be done until a broader set of correlation questions could be answered. EPA concerns relate to the most recent EPA/SwRI correlation work in which a Daimler-Benz HDD was tested at EPA and then shipped to SwRI. SwRI measured 20 percent lower HC and CO, 13 percent lower particulate, 16 percent higher NOx, 9 percent higher fuel consumption and 5 percent higher actual power.

Since the Cummins NTCC-400 was already planned to be part of the SwRI/CRC fuels study, and since the engine already had an extensive emissions test data base, it was decided that it should be the next engine to be tested at SwRI. However, before shipment to SwRI it was judged to be in the best interests of EPA and the CRC project to re-check the emissions levels of the engine at the EPA emissions testing facility. This was done and the purpose of this report is to discuss the results of this EPA testing.

II. Engine, Fuels and Test Plan

The engine used for this testing was a Cummins NTCC-400. This 400 horsepower engine is designed for the California 5.0 g/BHP-hr NOx standard and incorporates a Mechanical Variable Timing (MVT) system. This system senses boost pressure and changes injection timing from advanced to retarded when load is applied to the engine (i.e., at a given boost pressure). This system is easily configured to operate normally or in continuously advanced or continuously retarded modes. Thus three levels of HC, NOx and particulate are easily obtainable from this engine.

All previous EPA testing (June, 1985) was performed on EPA's batch of Phillips "DOE Reference" fuel known as batch G-075. The engine was returned to Cummins and there it was tested on Cummins in-house fuel, Cummins "Cert." fuel and on some G-075 fuel that EPA shipped to them in barrels. By the time the engine was returned to EPA, EPA had run out of G-075 and replaced it with a new batch of Phillips "DOE Reference" fuel, known as batch G-463. The bulk of EPA testing was performed on the "current" fuel, i.e., G-463. Some additional testing was performed on the old EPA fuel (G-075) and the Cummins "Cert" fuel for additional correlation data to compare to Cummins data.

The two batches of Phillips fuel are very similar in their properties. The new batch is three percent lower in Cetane Number and slightly lower in weight percent sulfur. The remainder of the properties are practically identical. The property analysis results of both fuels are presented in Table 1.

The test plan called for a set of 3 cold/hot transient tests to establish the "certification" type emission levels. The remainder of the work was with hot starts and included normal, advanced and retarded timing, all with the current EPA fuel (G-463). Hot start transients were also run on the old EPA fuel (G-075) and the Cummins "cert." fuel. Steady state data were obtained using the current EPA and Cummins "Cert." fuel.

III. Results

The results of this work are presented in Table 2 through 10. The reader is encouraged to review these tables, using the following narrative to assist in interpreting the data highlites contained therein.

Table 2 presents the torque lug map and resultant integrated reference horsepower. Comparing the current map to the previous EPA map it can be seen that the engine produced slightly less torque throughout the range, resulting in less integrated reference horsepower. The EPA torque map and the Cummins torque map are very similar in the region between peak torque speed (1300 RPM) and rated speed (2100 RPM). However, between 1000 and 1200 RPM there are some large differences between the maps. This is because this is a very steep part of the torque curve and minor differences in engine operation (pre-conditioning, etc.) can lead to large apparent differences in the torque map. Never the less, the integrated reference horsepowers are very close.

Table 3 presents the cold/hot combination "certification" type results from this engine. As can be seen from this data, the engine meets its design goals of less than 5 g/BHP-hr NOx at a particulate level less than 0.6 g/BHP-hr. It also has HC and CO levels below their respective standards. The coefficients of variability are very good for all measurements

Table 1

Table of Property Analysis Results for Previous EPA Diesel Test Fuel (G-075) and Current EPA Diesel Test Fuel (G-463)

Property	Phillips Analysis Results G-463	G-075
Cetane Number	44.8	46.2
Cetane Index	46.7	N/A*
Distillation Range		
IBP, °F	374	375
10%, °F	429	431
50%, °F	506	505
90%, °F	591	598
EP, °F	634	653
Sulfur, wt. %	0.31	0.35
Aromatics, minimum	32.3	32.1
Flashpoint, °F minimum	155	162
Viscosity, centistokes @ 40° C	2.43	2.52
Gravity, °API, 60°F	35.1	35.2
Copper Strip Corrosion, maximum	No. 1	N/A
Oxidation Stability, mg/100 ml, max.	0.4	N/A
Cloud Point, Maximum, °F	8	N/A
Particulate matter, maximum, mg/l	1.7	N/A
Carbon Density, grams carbon/gal.	2782	N/A
Net Heat of Combustion, BTU/lb.	19435	N/A

* Not available.

Table 2

Table of Torque Map Values and Resultant Reference BHP-Hr for Cummins NTCC-400 Correlation Engine

Speed	Current EPA Torque	Previous EPA Torque	Previous EPA % Diff.	Cummins Torque	Cummins % Diff.
677	514	517	0.6	517	0.6
777	510	550	7.8	523	2.5
877	529	594	12.3	555	4.9
977	583	691	18.5	583	0.0
1077	828	1098	32.6	608	-26.6
1177	1172	1189	1.5	1025	-12.5
1277	1221	1238	1.4	1221	0.0
1377	1240	1256	1.3	1229	-0.9
1477	1215	1236	1.7	1211	-0.3
1577	1186	1202	1.3	1177	-0.8
1677	1146	1160	1.2	1139	-0.6
1777	1113	1128	1.3	1105	-0.7
1877	1088	1095	0.6	1076	-1.1
1977	1061	1070	0.8	1051	-0.9
2077	1027	1040	1.3	1024	-1.5
2177	817	830	1.6	792	-4.6
2277	246	336	36.6	172	-48.8
2377	-191	-178		-356	
Reference BHP-Hr	26.736	27.356	2.3%	26.7	-0.1%

Table 3

Table of Composite Transient
Test Results From
Cummins NTCC-400
Correlation Engine
Standard Timing, EPA Fuel (G-463)

Test No	Emissions, g/BHP-hr.				BSFC, lb/BHP-hr.	Actual Work, BHP-hr.
	HC	CO	NOx	Part.		
3171	0.56	3.45	4.42	0.58	0.423	25.49
3174	0.50	2.98	4.52	0.55	0.411	25.66
3177	0.54	3.18	4.67	0.58	0.416	25.56
$\bar{X}$	0.53	3.20	4.54	0.57	0.417	25.57
COV %	5.73	7.36	2.77	3.04	1.44	0.33

except CO, which is about two percentage points above the level usually found. This can not be explained at this time, but is of little concern considering the very low absolute level of CO emissions relative to the standard. Cummins produced only hot start data and therefore there are no corresponding cold/hot combination data with which to compare these results.

Table 4 presents the hot start transient results at standard timing and using the current EPA fuel. The variability of the eight tests is generally within the expected range. Relative to the previous tests at EPA (all of which used G-075 fuel), the long term repeatability was quite good, except for particulate. However, after the previous EPA work was completed, it was discovered that the calibration of the particulate sampling system had shifted, and thus the current particulate data are the most representative for this engine. In comparing the EPA data to that of Cummins (all fuels included in the data base), good correlation is seen.

Table 5 presents the hot start results at advanced timing. The variation in the four tests is quite low. Compared to previous EPA data, there is generally good repeatability, expect for particulate and HC. The somewhat poor particulate repeatability is probably due to the previously mentioned calibration error. As to the HC difference, it will be discussed later. Comparing the EPA data to Cummins data, there is quite good correlation on particulate and NOx but Cummins measured HC 20 percent higher than EPA. Again, a possible reason for this will be discussed later.

Table 6 presents the hot start transient, retarded timing, EPA fuel results. Four such tests were run, with very good repeatability. Comparing current tests to previous tests, there was good repeatability, with the exception of particulate. The previous particulate data were probably low. Cummins results were quite close for NOx and particulate but were 21 percent low for HC.

Table 7 presents the data that came from EPA testing using the previous batch of fuel (G-075). In comparing the results from current testing of the old and new fuels, there are relatively small differences in all of the data with the exception of HC, where the "old fuel" HC results were 15 percent lower than the current fuel HC results. This is very surprising considering the similarity of the fuels and in fact could be due to a measurement error. This will be discussed later.

In comparing the current EPA tests with G-075 fuel to old EPA tests (which were with G-075 fuel), there is close similarity in all data except particulate and HC. The particulate discrepancy could be due to a previous calibration error and the HC discrepancy could be due to a HFID measurement

Table 4

Table of Hot Start
Transient Results From
Cummins NTCC-400
Correlation Engine
Standard Timing, EPA Fuel (G-463)

Test No	Emissions, g/BHP-hr HC	CO	NOx	Part.	BSFC, lb/BHP-hr.	Actual Work, BHP-hr.
3171	0.55	3.45	4.47	0.57	0.420	25.52
3172	0.59	3.46	4.51	0.54	0.418	25.58
3174	0.47	2.97	4.56	0.54	0.408	25.71
3175	0.49	3.04	4.76	0.53	0.413	25.65
3177	0.52	3.16	4.71	0.56	0.414	25.59
3178	0.53	3.18	4.73	0.57	0.409	25.54
$\bar{X}$	0.53	3.21	4.62	0.55	0.414	25.59
COV %	8.15	6.38	2.70	3.12	1.15	0.28
Previous EPA Tests (G-075 fuel)						
	0.49	3.00	4.51	0.45**	0.405	26.65
% difference relative to current tests						
	-7.55	-6.54	-2.38	-18.18	-2.17	4.14
Cummins data, all fuels						
	0.55	N/A*	4.65	0.51	N/A*	N/A*
% difference relative to EPA tests						
	3.77	-	0.65	-7.27	-	-

* N/A = not available.
** These data are thought to be low, due to an equipment calibration error.

Table 5

Table of Hot Start
Transient Test Results From
Cummins NTCC-400
Correlation Engine
Advanced Timing, EPA Fuel (G-463)

Test No.	Emission, g/BHP-hr. HC	CO	NOx	Part.	BSFC, lb/BHP-hr	Actual Work, lb/BHP-hr
3180	0.45	2.84	7.69	0.39	0.396	25.50
3181	0.37	2.72	7.55	0.40	0.389	25.59
3182	0.39	2.81	7.64	0.41	0.392	25.53
3183	0.38	2.80	7.62	(0.70)*	0.396	25.55
$\bar{X}$	0.40	2.79	7.62	0.40	0.393	25.54
COV %	9.04	1.83	0.76	2.50	0.86	0.15
Previous EPA Tests (G-075)						
	0.46	2.56	7.95	0.33**	0.390	26.56
% difference relative to current tests						
	15.00	-8.24	4.33	-17.50	-0.76	3.99
Cummins tests, all fuels						
	0.48	N/A***	8.29	0.38	N/A***	N/A***
% difference relative to EPA tests						
	20.00	-	8.79	-5.00	-	-

* This value is an obvious outlier and was thus not used in the calculations. The input data to this value were double checked and they appear to be correct. This high value could have been due to particulate slough off from the tunnel and/or particulate sampling system.

** These data are thought to be low, due to on equipment calibration error.

*** N/A = not available.

Table 6

Table of Hot Start
Transient Test Results From
Cummins NTCC-400
Correlation Engine
Retard Timing, EPA Fuel (G-463)

Test No.	Emissions, g/BHP-hr. HC	CO	NOx	Part	BSFC, lb/BHP-hr	Actual Work lb/BHP-hr
3184	1.25	4.11	3.89	0.71	0.419	25.88
3185	1.17	4.08	3.88	0.69	0.423	25.89
3186	1.12	4.00	4.03	0.69	0.427	25.81
3187	1.17	4.04	3.75	0.67	0.420	26.02
$\bar{X}$	1.18	4.06	3.89	0.69	0.422	25.90
COV %	4.56	1.18	2.94	2.37	0.85	0.34
Previous EPA tests (G-075 fuel)						
	1.19	4.18	3.55	0.60*	0.418	26.95
% difference relative to current tests						
	0.85	2.96	-8.74	-13.04	-0.95	4.05
Cummins tests, all fuels						
	0.93	N/A**	3.68	0.67	N/A**	N/A**
% difference relative to EPA tests						
	-21.19	-	-5.40	-2.90	-	-

* These data are thought to be low, due to on equipment calibration error.
** N/A = not available.

Table 7

Table of Hot Start
Transient Test Results From
Cummins NTCC-400
Correlation Engine
Standard Timing, Old EPA Fuel (G-075)

Test No	Emissions, g/BHP-hr. HC	CO	NOx	Part.	BSFC, lb/BHP-hr.	Actual Work BHP-hr
3188	0.48	3.12	4.25	0.54	0.412	25.76
3189	0.45	3.01	4.36	0.57	0.409	25.71
3190	0.43	2.89	4.45	0.51	0.408	25.90
$\bar{X}$	0.45	3.01	4.35	0.54	0.410	25.79
COV %	5.55	3.83	2.30	5.56	0.42	0.38
Current EPA Fuel (G-463) tested at EPA						
	0.53	3.21	4.62	0.55	0.414	25.59
% Difference relative to current EPA fuel						
	-15.1	-6.2	-5.8	-1.8	-1.0	0.8
Old EPA fuel (G-075) tested previously by EPA						
	0.49	3.00	4.51	0.45	0.405	26.65
% Difference relative to current tests using the old EPA fuel						
	8.9	-0.3	3.7	-16.7	-1.2	3.3
Old EPA fuel (G-075) tested at Cummins						
	0.57	N/A*	4.46	0.51	N/A	N/A
% Difference relative to old EPA fuel (G-075) tested at EPA						
	26.7	-	2.5	-5.6	-	-

* N/A = not available.

error (to be discussed below). In comparing the EPA G-075 fuel data to Cummins data on the same fuel, there is reasonably good correlation on particulate and NOx but poor correlation on HC, with EPA much lower than Cummins.

Table 8 presents data from EPA testing of the Cummins "Cert." fuel. In comparing the EPA tests of the Cummins fuel to EPA tests with G-463, we see lower values for all emissions, which is to be expected because of the higher quality of this Cummins fuel. However, the 13 percent difference in HC is greater than expected and could be due to an EPA measurement error.

Tables 9 and 10 present the steady state data taken. The main item of interest from those tables is that the variation in the data is quite low. The main reason for taking this data is to have it available for use by labs who will test the engine in the future.

In the above presentation of data and discussion of it, it is apparent that there is generally good correlation on all measurements except hydrocarbon. This may be due to an error in the EPA measurement system. In testing the engine immediately after the Cummins (a Ford 7.8 liter diesel), a leak in the filter housing located in the HFID oven was detected. In tests on the Ford before the problem was discovered, the average hot start transient HC was 0.63 g/BHP-hr. After repair of the problem, average hot start results were 0.86. Thus, the in-error data were 26.7 percent lower than the HC data judged to be correct.

How long previous to the detection of the leak it existed, and how it influenced the data becomes a major question. There are two ways to try to answer it. The first is to track all of the hot starts using EPA fuel (G-463) and standard timing versus time. This is shown in Graph 1. (Test numbers 3194 through 3211 were from the testing of this engine in a subsequent program.) Here it is seen that there is a distinct drop in HC results after test 3172, suggesting that the problem could have initiated with the tests of July 14.

Graph 2 displays the Cold-Hot FID Index results as a function of test number (and therefore time). The Cold-Hot FID Index is a measure being developed at the MVEL as an additional check on HFID values. It is the percent difference between a cold FID bag reading and the continuous HFID reading, relative to the latter. It is sensitive to hydrocarbon type and thus operating mode, engine type and other variables. Although the data base on this index is still being developed, some conclusions can be drawn. For example, based on previous engines the composite (bags 1-4) Index for standard timing would be expected to be in the -40 to -50 range. In reviewing Graph 2, it can be seen that only the first two standard timing hot starts fall in this range. The remainder are about 16 percent lower.

Table 8

Table of Hot Start Transient
Test Results From
Cummins NTCC-400
Standard Timing, Cummins "Cert" Fuel

Test No.	Emissions, g/BHP-hr. HC	CO	NOx	Part.	BSFC, lb/BHP-hr.	Actual Work BHP-hr
	3191	0.51	3.10	4.34	0.52	0.410
25.69						
3192	0.46	3.06	4.30	0.52	0.406	25.70
3193	0.42	3.00	4.27	0.53	0.409	25.66
$\bar{X}$	0.46	3.05	4.30	0.52	0.408	25.68
COV %	9.73	1.65	0.82	1.10	0.51	0.08
Current EPA fuel (G-463)						
	0.53	3.21	4.62	0.55	0.414	25.59
% Difference relative to current EPA fuel (G-463)						
	-13.2	-5.0	-6.9	-5.5	-1.5	0.4
Cummins Fuel tested at Cummins						
	0.54	N/A*	4.61	0.57	N/A	N/A
% Difference relative to EPA tests using Cummins fuel						
	17.4	-	7.2	9.6	-	-

* N/A = not available.

Table 9

Table of Steady State
Emissions Results from
Cummins NTCC-400
Correlation Engine
Standard Timing - Various Fuels

Fuel	Speed, RPM	Load ft.lb.	Test No	Emissions, g/hr HC	CO	NOx	Part.*	CO_2
EPA	630	24	3173	74.99	52.29	35.34	8.91	5175.35
			3176	74.26	65.29	35.31	8.93	4782.30
			3179	73.64	56.52	35.58	10.03	4818.29
			$\bar{X}$	74.30	58.03	35.41	9.29	4925.31
			COV %	0.91	11.43	0.42	6.90	4.41
				Emissions, g/BHP-hr				
EPA	1300	316	3173	0.37	0.83	6.45	0.396	536.86
			3176	0.36	0.77	6.22	0.396	522.25
			3179	0.41	0.80	6.34	0.309	529.80
			$\bar{X}$	0.38	0.80	6.34	0.367	529.64
			COV %	6.96	3.75	1.81	13.69	1.38
CEC	1300	316	3212	0.39	0.77	-	-	528.90
			Δ%	2.63	-3.75	-	-	-0.14
EPA	1300	516	3173	0.22	0.91	7.47	0.304	496.92
			3176	0.23	0.89	7.49	0.344	485.53
			3179	0.23	0.89	7.16	0.275	492.71
			$\bar{X}$	0.23	0.90	7.37	0.308	491.72
			COV %	1.30	1.29	2.51	11.26	1.17

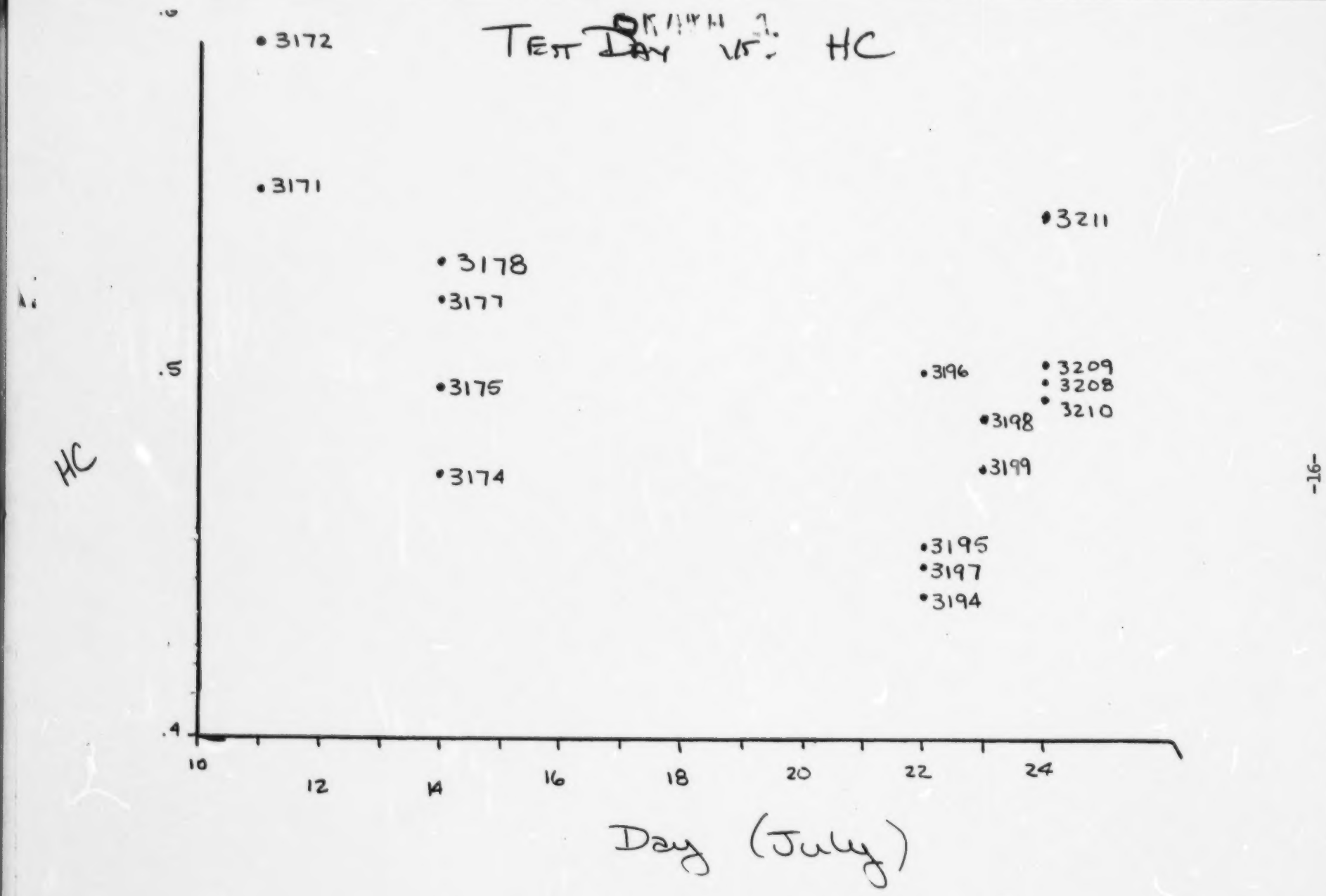
* Primary plus Secondary filter weights used to compute these data.

Table 10

Table of Steady State
Emissions Results from
Cummins NTCC-400
Correlation Engine
Standard Timing - Various Fuels

Fuel	Speed, RPM	Load, FT-lb	Test No	Emissions, g/BHP-hr HC	CO	NOX	Part.*	CO_2
EPA	2100	250	3173	1.12	1.31	3.06	0.524	729.91
			3176	1.14	1.26	3.01	0.512	714.78
			3179	1.09	1.26	3.08	0.542	718.36
			$\bar{X}$	1.12	1.28	3.05	0.526	721.02
			COV %	2.25	2.26	1.18	2.87	1.09
CEC	2100	250	3212	1.07	1.27	-	-	728.77
			Δ%	-4.46	-0.78	-	-	1.07
EPA	2100	750	3173	0.256	0.80	4.20	0.248	578.57
			3176	0.265	0.80	4.17	0.255	560.75
			3179	0.257	0.76	3.85	0.248	555.26
			$\bar{X}$	0.259	0.79	4.07	0.250	564.86
			COV %	1.90	2.94	4.76	1.61	2.16
CEC	2100	750	3212	0.228	.77	-	-	572.27
			Δ,%	-11.97	-2.53	-	-	1.31

* Primary plus Secondary filter weights used to compute these data.


Test Day vs. HC
.6
.5
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HC
3172
3171
3211
3178
3177
3196
3209
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3198
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Thus, there is strong evidence that the HC measurements taken were inaccurate. An adjustment was made to them and the results are presented in Table 11. The "description" column of this table identifies the table and the data that are involved in the analysis. The HC "initial" column is a repeat of the HC data found in Tables 4 through 8. The HC "revised" column contains the best estimate corrected HC data and is based on the Cold-Hot FID Index data where it is assumed that the cold FID data are correct. The percent difference "initial" column is a repeat of the percent difference figures found in Tables 4 through 8 and the percent difference "revised" is based on the revised HC figures. In reviewing this table it is seen that the revised HC data results in a reduction of the absolute value of the percent difference in 8 of the 11 cases.

Ultimately, it is not known how to best correct the HC data. However, from the data presented it is felt that the emissions from the engine have not shifted to any great degree. Thus, in the event one would rather not rely on the above described "revised" HC data, then the next best approach would be to rely on the HC data from the previous EPA testing.

IV. Summary

To briefly summarize, there were some measurement problems with HC (current tests) and particulate tests (previous EPA tests). However, when these problems are accounted for, generally good correlation is seen between present and past EPA tests and between EPA tests and those at Cummins. The notable exception is hydrocarbon during retarded mode, where Cummins measures substantially lower levels relative to EPA. This difference is currently unexplained.

Table 11
Table of Initial and Revised
HC Values from EPA Testing

Description	HC, g/BHP-hr.		Percent Difference	
	Initial	Revised	Initial	Revised
Table 4				
Standard Timing G-463 fuel				
Hot Start Results	0.53	0.57		
Previous EPA tests (G-075 fuel)	0.49	NC*	-7.55	-13.3
Cummins data, all fuels	0.55	NC	3.77	- 3.51
Table 5				
Advanced Timing, G-463 fuel				
Hot Start Results	0.40	0.45		
Previous EPA tests (G-075 fuel)	0.46	NC	15.00	2.22
Cummins data, all fuels	0.48	NC	20.00	6.67
Table 6				
Retarded Timing, G-463 fuel				
Hot Start Results	1.18	1.32		
Previous EPA tests (G-075 fuel)	1.19	NC	0.85	-9.85
Cummins data, all fuels	0.93	NC	-21.19	-29.55
Table 7				
Standard Timing, G-075 fuel				
Hot Start Results	0.45	0.50		
Current EPA fuel (G-463)	0.53	0.57	-15.1	-12.3
G-075 fuel tested. prev. by EPA	0.49	NC	8.9	-2.00
G-075 fuel tested at Cummins	0.57	NC	26.7	14.00
Table 8				
Standard Timing, Cummins fuel				
Hot Start Results	0.46	0.52		
Current EPA fuel (G-463)	0.53	0.57	-13.2	-8.77
Cummins fuel tested at Cummins	0.54	NC	17.4	3.85

* No change.

Appendix

Table of Contents

EPA Torque Map - Graph
EPA Torque Map - Table
EPA Emission Summaries for each test
Engine Information Sheet
Cummins Torque Map - Table
Cummins Torque Map - Graph

Graph of EPA Torque Map

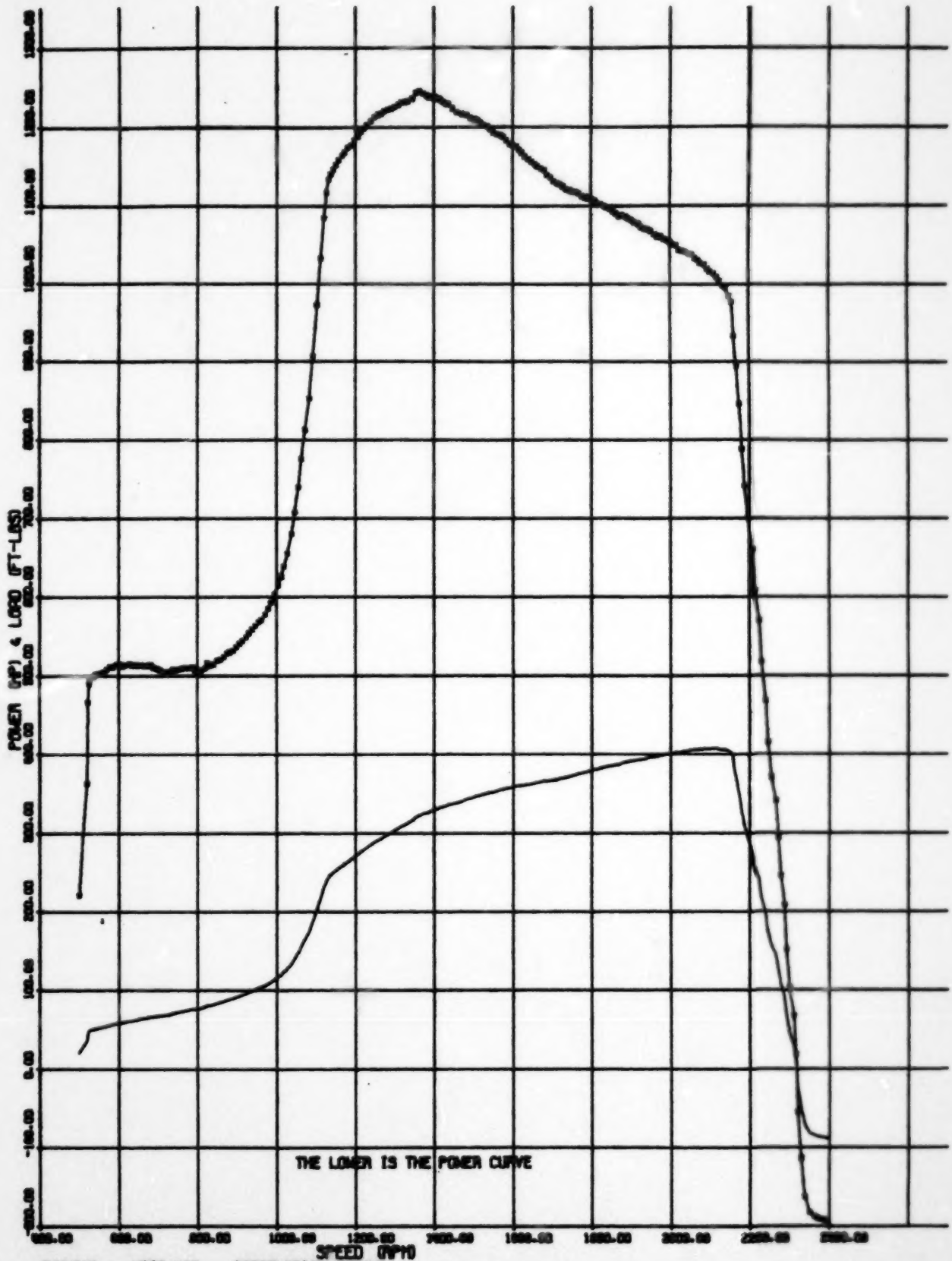
POWER (HP) & LOAD (FT-LBS)
SPEED (RPM)
THE LOWER IS THE POWER CURVE
CUMMINS NTCC-400 CORRELATION ENGINE
MAX TORQ =1245 FT-LBS MAX POWER = 407.5BHP MEASURED RATED RPM = 2057.62 MAPPING DATE = 7/ 02/ 88

Table of EPA Torque Map Values

NTCC-400
7/2/86

SMMW:
7000D
CD5162

```
 THERE  ARE ( 240 ) MAPPING DATA POINTS:
 499. 220.9  811. 507.4 1138.1140.9 1437.1228.9 1776.1112.9 2095.1019.3
 519. 363.4  819. 509.7 1144.1146.9 1447.1223.3 1785.1111.7 2102.1016.5
 521. 466.1  825. 516.5 1150.1153.0 1458.1218.6 1791.1109.4 2111.1013.7
 524. 489.4  832. 513.3 1157.1158.9 1471.1216.1 1800.1108.6 2119.1009.3
 527. 495.3  841. 514.1 1166.1164.5 1482.1215.0 1809.1106.6 2125.1003.7
 535. 499.4  850. 519.3 1173.1168.6 1493.1211.3 1815.1103.3 2134.  998.1
 541. 502.1  858. 520.9 1180.1174.5 1503.1210.1 1825.1102.1 2141.  995.7
 547. 502.2  867. 524.1 1188.1177.0 1510.1208.5 1832.1100.5 2150.  985.0
 554. 503.4  874. 528.6 1197.1183.8 1517.1205.0 1840.1098.6 2157.  976.9
 563. 505.3  881. 529.8 1206.1188.2 1526.1202.2 1848.1096.5 2161.  933.0
 570. 508.1  890. 532.1 1213.1195.0 1536.1200.9 1855.1092.9 2167.  894.2
 579. 511.3  898. 536.9 1221.1198.5 1543.1197.7 1863.1090.5 2174.  845.7
 586. 511.3  906. 541.3 1229.1202.9 1550.1192.5 1870.1086.5 2180.  788.1
 594. 514.6  914. 544.6 1239.1208.1 1560.1191.0 1879.1088.5 2188.  741.4
 603. 514.1  923. 549.4 1249.1213.0 1569.1189.7 1887.1086.2 2196.  701.3
 609. 512.5  930. 554.5 1257.1216.1 1575.1187.3 1894.1084.2 2206.  660.6
 618. 513.8  939. 558.9 1266.1216.9 1583.1182.9 1902.1082.1 2211.  608.2
 627. 515.0  947. 563.4 1273.1220.1 1592.1178.5 1909.1078.6 2221.  570.1
 635. 513.7  955. 568.2 1283.1222.5 1599.1177.3 1920.1076.9 2227.  517.4
 642. 513.7  962. 570.9 1292.1223.4 1609.1175.3 1926.1073.0 2236.  467.7
 649. 513.8  972. 578.1 1300.1225.7 1616.1171.0 1935.1070.5 2242.  415.4
 657. 513.7  979. 585.0 1309.1228.1 1622.1168.1 1943.1070.1 2251.  370.9
 668. 512.5  987. 593.3 1317.1231.3 1631.1162.9 1951.1067.8 2263.  341.3
 675. 513.7  995. 603.3 1326.1231.7 1639.1159.3 1961.1063.7 2269.  293.7
 681. 513.3 1005. 614.9 1334.1232.6 1648.1156.1 1968.1060.5 2277.  246.1
 688. 510.5 1012. 626.1 1344.1236.1 1656.1152.5 1976.1060.6 2285.  208.5
 698. 509.0 1019. 639.0 1354.1243.0 1663.1150.1 1985.1057.8 2290.  151.3
 706. 506.9 1028. 655.3 1362.1244.9 1672.1147.7 1992.1055.7 2299.  103.3
 713. 505.3 1039. 680.2 1372.1241.8 1680.1145.8 2001.1053.4 2308.   67.7
 721. 503.8 1046. 707.8 1381.1239.7 1687.1139.7 2007.1050.1 2315.   18.2
 730. 505.4 1056. 739.3 1387.1237.3 1696.1136.2 2015.1049.7 2318. -54.5
 739. 508.1 1063. 775.7 1394.1238.5 1704.1131.8 2023.1044.1 2328.-113.3
 745. 507.3 1073. 812.1 1398.1237.0 1713.1128.9 2031.1042.5 2338.-163.0
 753. 508.1 1083. 852.1 1403.1238.2 1720.1127.8 2040.1041.0 2350.-182.5
 760. 509.7 1093. 906.6 1405.1236.1 1727.1124.9 2050.1038.5 2361.-187.7
 769. 510.2 1102. 972.9 1409.1236.1 1736.1121.3 2056.1038.2 2370.-190.1
 778. 510.1 1112.1032.5 1413.1235.4 1744.1120.9 2063.1033.3 2380.-191.3
 786. 510.9 1120.1085.3 1418.1233.7 1750.1118.5 2072.1030.5 2388.-192.1
 793. 507.4 1127.1117.3 1423.1231.7 1760.1117.7 2076.1026.9 2393.-192.1
 802. 501.8 1132.1134.1 1429.1229.8 1769.1116.1 2087.1024.6 2394.-191.7
<COMMENT>  MAX POWER: 407.4 HP   @ 2111. RPM.
<COMMENT>  RATED SPEED: 2067. RPM.
 WANT A CALCOMP PLOT OF THE MAPPING CURVE? (Y/N), (DEFLT = N):

DO YOU WANT THE RPM,TQ & HP DATA LIST?(Y/N): Y
```

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863171
TEST DATE/TIME: 7- 9-86 8:27
MANUFACTURER: CUMMINS
ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 28.90 "HG
DRY BULB TEMPERATURE: 75.40 F
ABSOLUTE HUMIDITY: 54.10 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	5.73	5.95	
EXHAUST+BKG, GM	19.37	19.06	
NET, GM/BHP-HR	0.576	0.552	0.555
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	67.74	88.02	
NET, GM/BHP-HR	3.47	3.45	3.45
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	110.05	120.27	
NET, GM/BHP-HR	4.124	4.470	4.421
CO2 (BAG)			
BACKGROUND, PPM	0.037	0.036	
EXHAUST+BKG, GM	16936.89	16273.41	
NET, GM/BHP-HR	630.9	600.4	604.8
PARTICULATE			
SECONDARY TARE, GM	0.156600	0.157900	
SECONDARY PART, GM	0.156700	0.158000	
PRIMARY TARE, GM	0.156900	0.155500	
PRIMARY PART, GM	0.168400	0.165800	
TOTAL, GM/BHP-HR	0.65	0.57	0.58
FUEL CONSUMPTION			
LBS	11.17	10.73	10.79
LBS/BHP-HR	0.442	0.420	0.423
BRAKE HORSEPOWER-HOUR	25.308	25.516	25.486

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	1176	1176
SLOPE	0.99623	0.99713
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	3.728	1.689
(LIMIT: +-50 RPM)		
STD ERROR	25.496	25.298
(LIMIT: 100 RPM)		
R-SQUARE	0.99821	0.99824
(LIMIT: 0.97)		
TORQUE		
NUMBER	944	953
SLOPE	1.00404	1.00420
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	-11.282	-11.168
(LIMIT: +-15 FT-LBS)		
STD ERROR	4.588%	4.376%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.96968	0.97301
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	943	953
SLOPE	0.99991	0.99995
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	-2.492	-2.574
(LIMIT: +-5 BHP)		
STD ERROR	4.295%	4.030%
(LIMIT: 8%)		
R-SQUARE	0.97886	0.98165
(LIMIT: 0.91)		
WORK		
ACTUAL	25.308	25.516
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	26.736	26.737
% DIFFERENCE	-5.34%	-4.57%

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HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-11-86 TIME: 15:16:11 HD-863172

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863172 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7- 9-86 10: 2 ENGINE ID: 740 NTCC40085HCC0R02 2

AMBIENT DATA

BAROMETER (DRY): 28.90 "HG
DRY BULB TEMPERATURE: 76.00 F
ABSOLUTE HUMIDITY: 51.75 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.25	
EXHAUST+BKG, GM	0.00	20.29	
NET, GM/BHP-HR	0.000	0.589	0.589
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	88.57	
NET, GM/BHP-HR	0.00	3.46	3.46
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	122.30	
NET, GM/BHP-HR	0.000	4.508	4.508
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.033	
EXHAUST+BKG, GM	0.00	16118.07	
NET, GM/BHP-HR	0.0	596.6	596.6
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.158300	
SECONDARY PART, GM	0.000000	0.158400	
PRIMARY TARE, GM	0.000000	0.153800	
PRIMARY PART, GM	0.000000	0.163600	
TOTAL, GM/BHP-HR	0.00	0.54	0.54
FUEL CONSUMPTION			
LBS	0.00	10.69	10.69
LBS/BHP-HR	0.000	0.418	0.418
BRAKE HORSEPOWER-HOUR	0.000	25.583	25.583

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99576
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	4.326
(LIMIT, +-50 RPM)		
STD ERROR	0.000	25.315
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99824
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	952
SLOPE	0.00000	1.00006
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-7.966
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.448%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97181
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	951
SLOPE	0.00000	0.99927
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-2.199
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.084%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98112
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.583
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.31%

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863174
TEST DATE/TIME: 7-10-86 8:18

MANUFACTURER: CUMMINS
ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 73.10 F
ABSOLUTE HUMIDITY: 65.18 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	5.28	6.10	
EXHAUST+BKG, GM	21.08	17.28	
NET, GM/BHP-HR	0.655	0.472	0.498
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	77.78	76.33	
NET, GM/BHP-HR	3.06	2.97	2.98
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	110.80	120.23	
NET, GM/BHP-HR	4.253	4.561	4.517
CO2 (BAG)			
BACKGROUND, PPM	0.037	0.036	
EXHAUST+BKG, GM	16488.24	15952.20	
NET, GM/BHP-HR	610.6	583.4	587.2
PARTICULATE			
SECONDARY TARE, GM	0.156100	0.158000	
SECONDARY PART, GM	0.156200	0.158100	
PRIMARY TARE, GM	0.154600	0.154600	
PRIMARY PART, GM	0.165650	0.164400	
TOTAL, GM/BHP-HR	0.62	0.54	0.55
FUEL CONSUMPTION			
LBS	10.85	10.49	10.54
LBS/BHP-HR	0.427	0.408	0.411
BRAKE HORSEPOWER-HOUR	25.403	25.706	25.663

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	1176	1176
SLOPE	0.99405	0.99392
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	6.348	4.858
(LIMIT: +-50 RPM)		
STD ERROR	24.937	25.052
(LIMIT: 100 RPM)		
R-SQUARE	0.99828	0.99827
(LIMIT: 0.97)		
TORQUE		
NUMBER	949	959
SLOPE	0.99611	0.98940
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	-5.455	-0.289
(LIMIT: +-15 FT-LBS)		
STD ERROR	4.605%	4.460%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.96985	0.97208
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	948	959
SLOPE	0.99754	0.99476
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	-1.846	-1.330
(LIMIT: +-5 BHP)		
STD ERROR	4.252%	4.029%
(LIMIT: 8%)		
R-SQUARE	0.97960	0.98192
(LIMIT: 0.91)		
WORK		
ACTUAL	25.403	25.706
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	26.736	26.737
% DIFFERENCE	-4.99%	-3.86%

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863175 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-10-86 9:52 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.00 "HG
DRY BULB TEMPERATURE: 74.70 F
ABSOLUTE HUMIDITY: 78.32 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.77	
EXHAUST+BKG, GM	0.00	18.34	
NET, GM/BHP-HR	0.000	0.493	0.493
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	77.99	
NET, GM/BHP-HR	0.00	3.04	3.04
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	120.91	
NET, GM/BHP-HR	0.000	4.756	4.756
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.030	
EXHAUST+BKG, GM	0.00	15919.00	
NET, GM/BHP-HR	0.0	590.1	590.1
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.169000	
SECONDARY PART, GM	0.000000	0.169050	
PRIMARY TARE, GM	0.000000	0.165900	
PRIMARY PART, GM	0.000000	0.175400	
TOTAL, GM/BHP-HR	0.00	0.53	0.53
FUEL CONSUMPTION			
LBS	0.00	10.58	10.58
LBS/BHP-HR	0.000	0.413	0.413
BRAKE HORSEPOWER-HOUR	0.000	25.646	25.646

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99270
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	6.304
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.044
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99826
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	954
SLOPE	0.00000	0.99075
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-1.481
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.489%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97113
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	953
SLOPE	0.00000	0.99298
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.382
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.056%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98132
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.646
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.08%

TEST NUMBER: HD-863177 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-14-86 8:36 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 75.60 F
ABSOLUTE HUMIDITY: 74.97 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	4.09	5.28	
EXHAUST+BKG, GM	20.13	17.73	
NET, GM/BHP-HR	0.657	0.519	0.539
[illegible]			
[illegible]	0.00	0.00	
[illegible]	83.69	80.95	
[illegible]	3.29	3.16	3.18
[illegible] (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	112.01	120.49	
NET, GM/BHP-HR	4.409	4.709	4.666
CO2 (BAG)			
BACKGROUND, PPM	0.034	0.033	
EXHAUST+BKG, GM	16580.63	15993.81	
NET, GM/BHP-HR	617.7	591.4	595.2
PARTICULATE			
SECONDARY TARE, GM	0.157600	0.168200	
SECONDARY PART, GM	0.157900	0.168400	
PRIMARY TARE, GM	0.146300	0.163500	
PRIMARY PART, GM	0.159600	0.173900	
TOTAL, GM/BHP-HR	0.73	0.56	0.58
FUEL CONSUMPTION			
LBS	10.98	10.59	10.64
LBS/BHP-HR	0.432	0.414	0.416
BRAKE HORSEPOWER-HOUR	25.406	25.588	25.562

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	1176	1176
SLOPE	0.99579	0.99440
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	4.804	6.835
(LIMIT: +-50 RPM)		
STD ERROR	25.158	24.977
(LIMIT: 100 RPM)		
R-SQUARE	0.99826	0.99828
(LIMIT: 0.97)		
TORQUE		
NUMBER	949	956
SLOPE	1.00029	0.99999
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	-8.109	-7.636
(LIMIT: +-15 FT-LBS)		
STD ERROR	4.590%	4.386%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.97035	0.97320
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	948	956
SLOPE	0.99912	0.99913
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	-2.102	-2.139
(LIMIT: +-5 BHP)		
STD ERROR	4.279%	4.014%
(LIMIT: 8%)		
R-SQUARE	0.97948	0.98207
(LIMIT: 0.91)		
WORK		
ACTUAL	25.406	25.588
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	26.736	26.737
% DIFFERENCE	-4.97%	-4.30%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863178 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-14-86 10: 5 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 77.50 F
ABSOLUTE HUMIDITY: 78.33 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.03	
EXHAUST+BKG, GM	0.00	18.69	
NET, GM/BHP-HR	0.000	0.533	0.533
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	81.08	
NET, GM/BHP-HR	0.00	3.18	3.18
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	120.40	
NET, GM/BHP-HR	0.000	4.728	4.728
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.034	
EXHAUST+BKG, GM	0.00	15845.11	
NET, GM/BHP-HR	0.0	584.8	584.8
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.160000	
SECONDARY PART, GM	0.000000	0.160200	
PRIMARY TARE, GM	0.000000	0.164000	
PRIMARY PART, GM	0.000000	0.173700	
TOTAL, GM/BHP-HR	0.00	0.57	0.57
FUEL CONSUMPTION			
LBS	0.00	10.45	10.45
LBS/BHP-HR	0.000	0.409	0.409
BRAKE HORSEPOWER-HOUR	0.000	25.538	25.538

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99484
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	5.058
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.252
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99824
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	952
SLOPE	0.00000	1.00243
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-9.418
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.409%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97241
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	951
SLOPE	0.00000	0.99935
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-2.337
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.053%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98140
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.538
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.48%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863180 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-15-86 14:22 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 73.90 F
ABSOLUTE HUMIDITY: 72.91 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	4.54	
EXHAUST+BKG, GM	0.00	15.40	
NET, GM/BHP-HR	0.000	0.453	0.453
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	72.40	
NET, GM/BHP-HR	0.00	2.84	2.84
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	197.27	
NET, GM/BHP-HR	0.000	7.693	7.693
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.031	
EXHAUST+BKG, GM	0.00	15282.59	
NET, GM/BHP-HR	0.0	566.8	566.8
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.149400	
SECONDARY PART, GM	0.000000	0.149400	
PRIMARY TARE, GM	0.000000	0.153900	
PRIMARY PART, GM	0.000000	0.161200	
TOTAL, GM/BHP-HR	0.00	0.39	0.39
FUEL CONSUMPTION			
LBS	0.00	10.10	10.10
LBS/BHP-HR	0.000	0.396	0.396
BRAKE HORSEPOWER-HOUR	0.000	25.502	25.502

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99504
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	3.519
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.825
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99816
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	957
SLOPE	0.00000	1.00737
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-11.982
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.348%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97420
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	956
SLOPE	0.00000	1.00203
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-2.741
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.005%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98238
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.502
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.62%

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HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-17-86 TIME: 16:10:01 HD-863181

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863181 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-15-86 15: 2 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 72.90 F
ABSOLUTE HUMIDITY: 69.76 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.66	
EXHAUST+BKG, GM	0.00	14.15	
NET, GM/BHP-HR	0.000	0.365	0.365
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	69.51	
NET, GM/BHP-HR	0.00	2.72	2.72
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.50	
EXHAUST+BKG, GM	0.00	197.35	
NET, GM/BHP-HR	0.000	7.553	7.553
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.032	
EXHAUST+BKG, GM	0.00	15100.89	
NET, GM/BHP-HR	0.0	556.9	556.9
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.163900	
SECONDARY PART, GM	0.000000	0.163900	
PRIMARY TARE, GM	0.000000	0.160000	
PRIMARY PART, GM	0.000000	0.167600	
TOTAL, GM/BHP-HR	0.00	0.40	0.40
FUEL CONSUMPTION			
LBS	0.00	9.96	9.96
LBS/BHP-HR	0.000	0.389	0.389
BRAKE HORSEPOWER-HOUR	0.000	25.594	25.594

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99429
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	4.032
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.734
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99817
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	957
SLOPE	0.00000	0.99659
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-4.589
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.463%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97227
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	956
SLOPE	0.00000	0.99771
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.882
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.052%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98181
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.594
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.27%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863182
TEST DATE/TIME: 7-15-86 15:43

MANUFACTURER: CUMMINS
ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 72.30 F
ABSOLUTE HUMIDITY: 72.21 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS

	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.36	
EXHAUST+BKG, GM	0.00	14.59	
NET, GM/BHP-HR	0.000	0.394	0.394
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	71.74	
NET, GM/BHP-HR	0.00	2.81	2.81
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	197.18	
NET, GM/BHP-HR	0.000	7.642	7.642
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.033	
EXHAUST+BKG, GM	0.00	15180.09	
NET, GM/BHP-HR	0.0	560.6	560.6
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.164300	
SECONDARY PART, GM	0.000000	0.164300	
PRIMARY TARE, GM	0.000000	0.164600	
PRIMARY PART, GM	0.000000	0.172300	
TOTAL, GM/BHP-HR	0.00	0.41	0.41
FUEL CONSUMPTION			
LBS	0.00	10.00	10.00
LBS/BHP-HR	0.000	0.392	0.392
BRAKE HORSEPOWER-HOUR	0.000	25.527	25.527

CYCLE STATISTICS

	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99585
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	1.551
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.640
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99819
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	958
SLOPE	0.00000	1.00176
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-8.290
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.419%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97320
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	957
SLOPE	0.00000	0.99929
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-2.309
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.050%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98194
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.527
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.52%

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863183 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-15-86 16:22 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 72.90 F
ABSOLUTE HUMIDITY: 71.68 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.51	
EXHAUST+BKG, GM	0.00	14.41	
NET, GM/BHP-HR	0.000	0.381	0.381
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	71.55	
NET, GM/BHP-HR	0.00	2.80	2.80
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	197.09	
NET, GM/BHP-HR	0.000	7.620	7.620
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.030	
EXHAUST+BKG, GM	0.00	15265.94	
NET, GM/BHP-HR	0.0	566.2	566.2
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.164600	
SECONDARY PART, GM	0.000000	0.164600	
PRIMARY TARE, GM	0.000000	0.169800	
PRIMARY PART, GM	0.000000	0.182900	
TOTAL, GM/BHP-HR	0.00	0.70	0.70
FUEL CONSUMPTION			
LBS	0.00	10.11	10.11
LBS/BHP-HR	0.000	0.396	0.396
BRAKE HORSEPOWER-HOUR	0.000	25.551	25.551

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99471
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	3.643
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.928
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99815
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	958
SLOPE	0.00000	0.99882
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-6.781
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.418%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97306
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	957
SLOPE	0.00000	0.99869
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-2.172
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.032%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98207
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.551
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.43%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863184 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-16-86 8:45 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 78.00 F
ABSOLUTE HUMIDITY: 85.84 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.28	
EXHAUST+BKG, GM	0.00	36.89	
NET, GM/BHP-HR	0.000	1.254	1.254
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	106.40	
NET, GM/BHP-HR	0.00	4.11	4.11
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	97.86	
NET, GM/BHP-HR	0.000	3.891	3.891
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.034	
EXHAUST+BKG, GM	0.00	16329.03	
NET, GM/BHP-HR	0.0	595.7	595.7
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.164600	
SECONDARY PART, GM	0.000000	0.164600	
PRIMARY TARE, GM	0.000000	0.169800	
PRIMARY PART, GM	0.000000	0.182900	
TOTAL, GM/BHP-HR	0.00	0.71	0.71
FUEL CONSUMPTION			
LBS	0.00	10.85	10.85
LBS/BHP-HR	0.000	0.419	0.419
BRAKE HORSEPOWER-HOUR	0.000	25.880	25.880

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99601
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	5.237
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.643
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99819
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	967
SLOPE	0.00000	0.99137
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-2.371
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.462%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.97305
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	966
SLOPE	0.00000	0.99497
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.455
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.042%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98215
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.880
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.20%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863185 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-16-86 13:49 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 78.40 F
ABSOLUTE HUMIDITY: 77.84 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.43	
EXHAUST+BKG, GM	0.00	34.71	
NET, GM/BHP-HR	0.000	1.165	1.165
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	105.54	
NET, GM/BHP-HR	0.00	4.08	4.08
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	99.58	
NET, GM/BHP-HR	0.000	3.875	3.875
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.032	
EXHAUST+BKG, GM	0.00	16416.35	
NET, GM/BHP-HR	0.0	601.8	601.8
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.162300	
SECONDARY PART, GM	0.000000	0.162500	
PRIMARY TARE, GM	0.000000	0.154800	
PRIMARY PART, GM	0.000000	0.167400	
TOTAL, GM/BHP-HR	0.00	0.69	0.69
FUEL CONSUMPTION			
LBS	0.00	10.96	10.96
LBS/BHP-HR	0.000	0.423	0.423
BRAKE HORSEPOWER-HOUR	0.000	25.890	25.890

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99735
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	3.771
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.533
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99821
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	967
SLOPE	0.00000	0.99198
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-2.817
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.766%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96940
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	966
SLOPE	0.00000	0.99634
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.548
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.122%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98150
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.890
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.16%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-17-86 TIME: 17:07:32 HD-863186

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863186
TEST DATE/TIME: 7-16-86 14:24
MANUFACTURER: CUMMINS
ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 75.90 F
ABSOLUTE HUMIDITY: 94.25 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS

	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.79	
EXHAUST+BKG, GM	0.00	34.51	
NET, GM/BHP-HR	0.000	1.117	1.117
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	103.28	
NET, GM/BHP-HR	0.00	4.00	4.00
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	98.81	
NET, GM/BHP-HR	0.000	4.030	4.030
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.030	
EXHAUST+BKG, GM	0.00	16481.23	
NET, GM/BHP-HR	0.0	607.9	607.9
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.161100	
SECONDARY PART, GM	0.000000	0.161100	
PRIMARY TARE, GM	0.000000	0.167000	
PRIMARY PART, GM	0.000000	0.179550	
TOTAL, GM/BHP-HR	0.00	0.69	0.69
FUEL CONSUMPTION			
LBS	0.00	11.03	11.03
LBS/BHP-HR	0.000	0.427	0.427
BRAKE HORSEPOWER-HOUR	0.000	25.814	25.814

CYCLE STATISTICS

	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99881
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	0.909
(LIMIT: +-50 RPM)		
STD ERROR	0.000	26.113
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99814
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	959
SLOPE	0.00000	0.99572
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-5.877
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.749%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96861
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	958
SLOPE	0.00000	0.99655
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.878
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.140%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98080
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.814
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.45%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-17-86 TIME: 17:07:44 HD-863187

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863187
TEST DATE/TIME: 7-17-86 8:50
MANUFACTURER: CUMMINS
ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.20 "HG
DRY BULB TEMPERATURE: 74.50 F
ABSOLUTE HUMIDITY: 81.03 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.34	
EXHAUST+BKG, GM	0.00	35.84	
NET, GM/BHP-HR	0.000	1.173	1.173
CO (BAG)			
BACKGROUND, PPM	0.00	0.48	
EXHAUST+BKG, GM	0.00	105.89	
NET, GM/BHP-HR	0.00	4.04	4.04
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	96.62	
NET, GM/BHP-HR	0.000	3.746	3.746
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.039	
EXHAUST+BKG, GM	0.00	16569.04	
NET, GM/BHP-HR	0.0	597.5	597.5
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.168650	
SECONDARY PART, GM	0.000000	0.168800	
PRIMARY TARE, GM	0.000000	0.160650	
PRIMARY PART, GM	0.000000	0.173100	
TOTAL, GM/BHP-HR	0.00	0.67	0.67
FUEL CONSUMPTION			
LBS	0.00	10.94	10.94
LBS/BHP-HR	0.000	0.420	0.420
BRAKE HORSEPOWER-HOUR	0.000	26.016	26.016

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99619
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	4.330
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.645
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99819
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	967
SLOPE	0.00000	0.98299
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	3.923
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.823%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96814
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	966
SLOPE	0.00000	0.99282
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-0.748
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.118%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98141
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	26.016
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-2.69%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 08-06-86 TIME: 09:55:26 HD-863188

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863188 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 8:45 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 74.50 F
ABSOLUTE HUMIDITY: 49.91 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	16.95	
NET, GM/BHP-HR	0.000	0.483	0.483
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	80.37	
NET, GM/BHP-HR	0.00	3.12	3.12
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	117.36	
NET, GM/BHP-HR	0.000	4.252	4.252
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.000	
EXHAUST+BKG, GM	0.00	16039.31	
NET, GM/BHP-HR	0.0	586.4	586.4
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.151900	
SECONDARY PART, GM	0.000000	0.151900	
PRIMARY TARE, GM	0.000000	0.156000	
PRIMARY PART, GM	0.000000	0.166000	
TOTAL, GM/BHP-HR	0.00	0.54	0.54
FUEL CONSUMPTION			
LBS	0.00	10.57	10.57
LBS/BHP-HR	0.000	0.410	0.410
BRAKE HORSEPOWER-HOUR	0.000	25.761	

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99740
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	4.466
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.395
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99823
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	955
SLOPE	0.00000	1.00233
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-6.893
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.718%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96901
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	954
SLOPE	0.00000	1.00359
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.960
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.113%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98123
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.761
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.65%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863189 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 9:20 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 75.60 F
ABSOLUTE HUMIDITY: 56.12 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.36	
EXHAUST+BKG, GM	0.00	15.99	
NET, GM/BHP-HR	0.000	0.447	0.447
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	77.32	
NET, GM/BHP-HR	0.00	3.01	3.01
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.50	
EXHAUST+BKG, GM	0.00	119.08	
NET, GM/BHP-HR	0.000	4.364	4.364
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.034	
EXHAUST+BKG, GM	0.00	15961.33	
NET, GM/BHP-HR	0.0	585.7	585.7
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.158100	
SECONDARY PART, GM	0.000000	0.158150	
PRIMARY TARE, GM	0.000000	0.158350	
PRIMARY PART, GM	0.000000	0.168700	
TOTAL, GM/BHP-HR	0.00	0.57	0.57
FUEL CONSUMPTION			
LBS	0.00	10.52	10.52
LBS/BHP-HR	0.000	0.409	0.409
BRAKE HORSEPOWER-HOUR	0.000	25.705	25.705

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99617
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	5.163
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.361
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99823
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	953
SLOPE	0.00000	0.99333
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-3.141
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.771%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96748
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	952
SLOPE	0.00000	0.99780
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.603
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.126%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98077
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.705
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.86%

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DIESEL SUMMARY REPORT

TEST NUMBER: HD-863190 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 10:50 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 74.10 F
ABSOLUTE HUMIDITY: 58.27 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.28	
EXHAUST+BKG, GM	0.00	15.46	
NET, GM/BHP-HR	0.000	0.426	0.426
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	74.76	
NET, GM/BHP-HR	0.00	2.89	2.89
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	120.31	
NET, GM/BHP-HR	0.000	4.452	4.452
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.034	
EXHAUST+BKG, GM	0.00	16016.72	
NET, GM/BHP-HR	0.0	584.5	584.5
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.163600	
SECONDARY PART, GM	0.000000	0.163700	
PRIMARY TARE, GM	0.000000	0.167700	
PRIMARY PART, GM	0.000000	0.177150	
TOTAL, GM/BHP-HR	0.00	0.51	0.51
FUEL CONSUMPTION			
LBS	0.00	10.58	10.58
LBS/BHP-HR	0.000	0.408	0.408
BRAKE HORSEPOWER-HOUR	0.000	25.897	25.897

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99515
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	6.706
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.688
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99818
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	958
SLOPE	0.00000	0.99065
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	1.452
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.809%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96759
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	957
SLOPE	0.00000	0.99924
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.035
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.140%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98102
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.897
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.14%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-21-86 TIME: 14:56:52 HD-863191

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863191 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 13:24 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 72.90 F
ABSOLUTE HUMIDITY: 54.87 GRAINS H2O / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	4.69	
EXHAUST+BKG, GM	0.00	17.16	
NET, GM/BHP-HR	0.000	0.515	0.515
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	79.58	
NET, GM/BHP-HR	0.00	3.10	3.10
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	117.43	
NET, GM/BHP-HR	0.000	4.344	4.344
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.032	
EXHAUST+BKG, GM	0.00	15885.99	
NET, GM/BHP-HR	0.0	586.0	586.0
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.165000	
SECONDARY PART, GM	0.000000	0.165100	
PRIMARY TARE, GM	0.000000	0.163800	
PRIMARY PART, GM	0.000000	0.173350	
TOTAL, GM/BHP-HR	0.00	0.52	0.52
FUEL CONSUMPTION			
LBS	0.00	10.53	10.53
LBS/BHP-HR	0.000	0.410	0.410
BRAKE HORSEPOWER-HOUR	0.000	25.687	25.687

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99540
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	4.919
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.676
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99819
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	952
SLOPE	0.00000	1.00020
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-6.372
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.755%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96792
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	951
SLOPE	0.00000	0.99990
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.911
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.131%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98071
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.687
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.92%

HEAVY DUTY DIESEL TRANSIENT ENGINE TEST DATE: 07-21-86 TIME: 10:42:08 HD-863192

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863192 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 14: 1 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 72.50 F
ABSOLUTE HUMIDITY: 53.84 GRAINS H2O / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	5.95	
EXHAUST+BKG, GM	0.00	16.78	
NET, GM/BHP-HR	0.000	0.458	0.458
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	78.54	
NET, GM/BHP-HR	0.00	3.06	3.06
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	117.42	
NET, GM/BHP-HR	0.000	4.305	4.305
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.034	
EXHAUST+BKG, GM	0.00	15814.15	
NET, GM/BHP-HR	0.0	580.9	580.9
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.163100	
SECONDARY PART, GM	0.000000	0.163200	
PRIMARY TARE, GM	0.000000	0.152750	
PRIMARY PART, GM	0.000000	0.162400	
TOTAL, GM/BHP-HR	0.00	0.52	0.52
FUEL CONSUMPTION			
LBS	0.00	10.44	10.44
LBS/BHP-HR	0.000	0.406	0.406
BRAKE HORSEPOWER-HOUR	0.000	25.702	25.702

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99604
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	3.847
(LIMIT: +-50 RPM)		
STD ERROR	0.000	25.980
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99814
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	954
SLOPE	0.00000	0.99461
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-3.546
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.778%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96750
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	953
SLOPE	0.00000	0.99764
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.655
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.143%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98057
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.702
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-3.87%

DIESEL SUMMARY REPORT

TEST NUMBER: HD-863193 MANUFACTURER: CUMMINS
TEST DATE/TIME: 7-18-86 14:42 ENGINE ID: 740 NTCC40085HCCOR02 2

AMBIENT DATA

BAROMETER (DRY): 29.10 "HG
DRY BULB TEMPERATURE: 73.30 F
ABSOLUTE HUMIDITY: 50.10 GRAINS H20 / LB. DRY AIR

EMISSION RESULTS	CS	HS	WTD TEST
HC (INTEGRATED)			
BACKGROUND, PPM	0.00	6.18	
EXHAUST+BKG, GM	0.00	16.00	
NET, GM/BHP-HR	0.000	0.421	0.421
CO (BAG)			
BACKGROUND, PPM	0.00	0.00	
EXHAUST+BKG, GM	0.00	76.94	
NET, GM/BHP-HR	0.00	3.00	3.00
NOX (INTEGRATED)			
BACKGROUND, PPM	0.00	0.25	
EXHAUST+BKG, GM	0.00	117.26	
NET, GM/BHP-HR	0.000	4.266	4.266
CO2 (BAG)			
BACKGROUND, PPM	0.000	0.033	
EXHAUST+BKG, GM	0.00	15873.81	
NET, GM/BHP-HR	0.0	584.8	584.8
PARTICULATE			
SECONDARY TARE, GM	0.000000	0.158400	
SECONDARY PART, GM	0.000000	0.158450	
PRIMARY TARE, GM	0.000000	0.165200	
PRIMARY PART, GM	0.000000	0.175000	
TOTAL, GM/BHP-HR	0.00	0.53	0.53
FUEL CONSUMPTION			
LBS	0.00	10.49	10.49
LBS/BHP-HR	0.000	0.409	0.409
BRAKE HORSEPOWER-HOUR	0.000	25.664	25.664

CYCLE STATISTICS	CS	HS
SPEED		
NUMBER	0	1176
SLOPE	0.00000	0.99635
(LIMIT: 0.97-1.03)		
Y-INTERCEPT	0.000	3.698
(LIMIT: +-50 RPM)		
STD ERROR	0.000	26.153
(LIMIT: 100 RPM)		
R-SQUARE	0.00000	0.99812
(LIMIT: 0.97)		
TORQUE		
NUMBER	0	955
SLOPE	0.00000	0.99528
(LIMIT: 0.77/0.83-1.03)		
Y-INTERCEPT	0.000	-4.590
(LIMIT: +-15 FT-LBS)		
STD ERROR	0.000%	4.758%
(LIMIT: 13% MAX ENG TQ)		
R-SQUARE	0.00000	0.96799
(LIMIT: 0.85/0.88)		
POWER		
NUMBER	0	954
SLOPE	0.00000	0.99782
(LIMIT: 0.87/0.89-1.03)		
Y-INTERCEPT	0.000	-1.796
(LIMIT: +-5 BHP)		
STD ERROR	0.000%	4.117%
(LIMIT: 8%)		
R-SQUARE	0.00000	0.98091
(LIMIT: 0.91)		
WORK		
ACTUAL	0.000	25.664
(LIMIT: -15%-5% REF BHP-HR)		
REFERENCE	0.000	26.736
% DIFFERENCE	0.00%	-4.01%

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TEST NO.: HD-863173 ENGINE: 740 NTCC400B5HCCOR02 2 TEST D/T: 7- 9-86 13:30 REPORT D/T: 07-11-86 13:38 P040684

WEIGHTED SUMMARY REPORT

AMBIENT DATA

AVERAGE BAROMETER (DRY) : 28.59 (" HG)
AVERAGE DRY BULB TEMPERATURE : 78.3 (DEG F)
AVERAGE ABSOLUTE HUMIDITY : 56.68 (GRAINS H2O/LB AIR)

MODE-TO-MODE RESULTS

MODE	SPEED (RPM)	TORQUE (FT-LB)	*UN* CORR BHP (HP)	MEASURED FUEL (LB/HR)	HC (GM/HR)	CO (GM/HR)	NOX (GM/HR)	CO2 (GM/HR)
1	1300	319.0	78.96	28.67	29.29	65.77	509.40	42389.92
2	1300	520.5	128.83	44.34	28.87	117.80	962.96	64019.51
3	2100	252.5	100.96	51.59	112.56	132.17	309.10	73691.09
4	2100	747.5	298.88	115.14	76.38	238.56	1256.41	172922.46
5	627	23.5	2.81	3.52	74.99	52.29	35.38	5175.35
WEIGHTED TOTALS			47.78	19.08	25.38	47.65	239.07	28090.66

EPA Heavy Duty (Cold)

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TEST NO.: HD-863176 ENGINE: 740 N1CC40085HCCOR02 2 TEST D/T: 7-10-86 13:30 REPORT D/T: 07-24-86 14:44 P040684

WEIGHTED SUMMARY REPORT

AMBIENT DATA

AVERAGE BAROMETER (DRY) : 28.51 (" HG)
AVERAGE DRY BULB TEMPERATURE : 79.1 (DEG F)
AVERAGE ABSOLUTE HUMIDITY : 81.80 (GRAINS H2O/LB AIR)

MODE-TO-MODE RESULTS

MODE	SPEED (RPM)	TORQUE (FT-LB)	*UN* CORR BHP (HP)	MEASURED FUEL (LB/HR)	HC (GM/HR)	CO (GM/HR)	NOX (GM/HR)	CO2 (GM/HR)
1	1300	317.5	78.59	28.77	28.36	60.83	489.07	41042.51
2	1300	516.0	127.72	44.12	29.41	113.23	956.37	62011.30
3	2100	251.5	100.56	49.72	114.50	126.55	302.15	71878.09
4	2100	747.0	298.68	111.39	79.12	239.57	1246.10	167485.40
5	630	21.5	2.58	3.49	74.26	65.29	35.31	4782.30
WEIGHTED TOTALS			47.60	18.62	25.67	47.63	235.80	27228.73

EPA hom. fuel. [5-4-2]

TEST NO.: HD-863179 ENGINE: 740 NTCC400B5HCCOR02 2 TEST D/T: 7-15-86 8: 0 REPORT D/T: 07-15-86 16:10 P040684

WEIGHTED SUMMARY REPORT

AMBIENT DATA

AVERAGE BAROMETER (DRY) : 28.70 (" HG)
AVERAGE DRY BULB TEMPERATURE : 80.6 (DEG F)
AVERAGE ABSOLUTE HUMIDITY : 77.77 (GRAINS H20/LB AIR)

MODE-TO-MODE RESULTS

MODE	SPEED (RPM)	TORQUE (FT-LB)	*UN* CORR BHP (HP)	MEASURED FUEL (LB/HR)	HC (GM/HR)	CO (GM/HR)	NOX (GM/HR)	CO2 (GM/HR)
1	1300	316.5	78.34	30.54	32.27	62.52	496.73	41504.48
2	1300	517.5	128.09	42.77	29.22	113.88	916.98	63112.50
3	2100	253.0	101.16	50.63	110.60	127.04	311.80	72669.09
4	2100	751.5	300.48	106.84	77.15	227.81	1155.50	166842.91
5	632	26.5	3.19	3.00	73.64	56.52	35.58	4818.29
WEIGHTED TOTALS			47.86	18.30	25.40	46.19	226.70	27362.38

EPA Highway fuel (G-463)

TEST NO.: HD-863212 ENGINE: 740 NTCC400B5HCCOR02 2 TEST D/T: 7-23-86 16:15 REPORT D/T: 07-24-86 13:58 P040684

WEIGHTED SUMMARY REPORT

AMBIENT DATA

AVERAGE BAROMETER (DRY) : 28.81 (" HG)
AVERAGE DRY BULB TEMPERATURE : 79.4 (DEG F)
AVERAGE ABSOLUTE HUMIDITY : 75.42 (GRAINS H2O/LB AIR)

MODE-TO-MODE RESULTS

MODE	SPEED (RPM)	TORQUE (FT-LB)	*UN* CORR BHP (HP)	MEASURED FUEL (LB/HR)	HC (GM/HR)	CO (GM/HR)	NOX (GM/HR)	CO2 (GM/HR)
1	2100	750.0	299.88	116.45	68.30	231.45	0.0	171611.72
2	2100	250.0	99.96	50.36	106.91	127.24	0.0	72848.08
3	1300	316.0	78.22	28.68	30.53	60.28	0.0	41368.83
WEIGHTED TOTALS			34.25	14.09	15.55	30.43	0.0	20578.13

Cummins Wt fuel

DIESEL INFORMATION SHEET

Manufacturer Cummins (740) Contact _____ Phone _____

ENGINE INFORMATION

1. Engine family and model NTCC 400
2. Serial number 10780756
3. Engine model year
4. Displacement 855
5. Fuel type (diesel #1 or (#2))
6. Required fuel pressure _____ (if not specified, 5 psig will be used)
7. Rated HP 400 @ 2100 rpm (Fuel rate ___ mm³/stroke ___ lbs/hr)
8. Max. TQ 1231 @ 1300 rpm (Fuel rate ___ mm³/stroke ___ lbs/hr)
9. Accumulated hours or mileage
10. Certified injection timing
11. Engine oil type 15W 40
12. (Nominal thermostat temperature ____°F)
13. Vehicle application/type of service COER

2100 } 387
965 TQ)
118.5 lb/ft
45.6 in-lb

1500
117.1 lb/ft

SET-UP INFORMATION

1. Max. full load gov. speed 2100 rpm
2. Curb idle speed ~~675~~ 600 rpm (max. safe N.L. speed 2350 rpm)
3. Inlet depression: 13-mode _____ "H_2O
   Transient 20 "H_2O
4. Exhaust backpressure: 13-mode _____ "H_2O
   Transient ~~2~~ 2 ~~"Hg~~ "H_2O as per T. Baines 2/1/86
5. Fuel shut-of system (man., 24v, (12v)) ~~HEV~~
6. Output shaft rotation (CW, CCW) CCW from back
   CW from front
7. (Supply fuel pressure _____ psi)

SPECIAL INSTRUCTIONS

Starting instructions, request for presence of company representative, intention to do restorative maintenance at EPA, engine disposition, etc.

80 PSI AIR 47

740 NTCC 400 85 HCCOR02 V02

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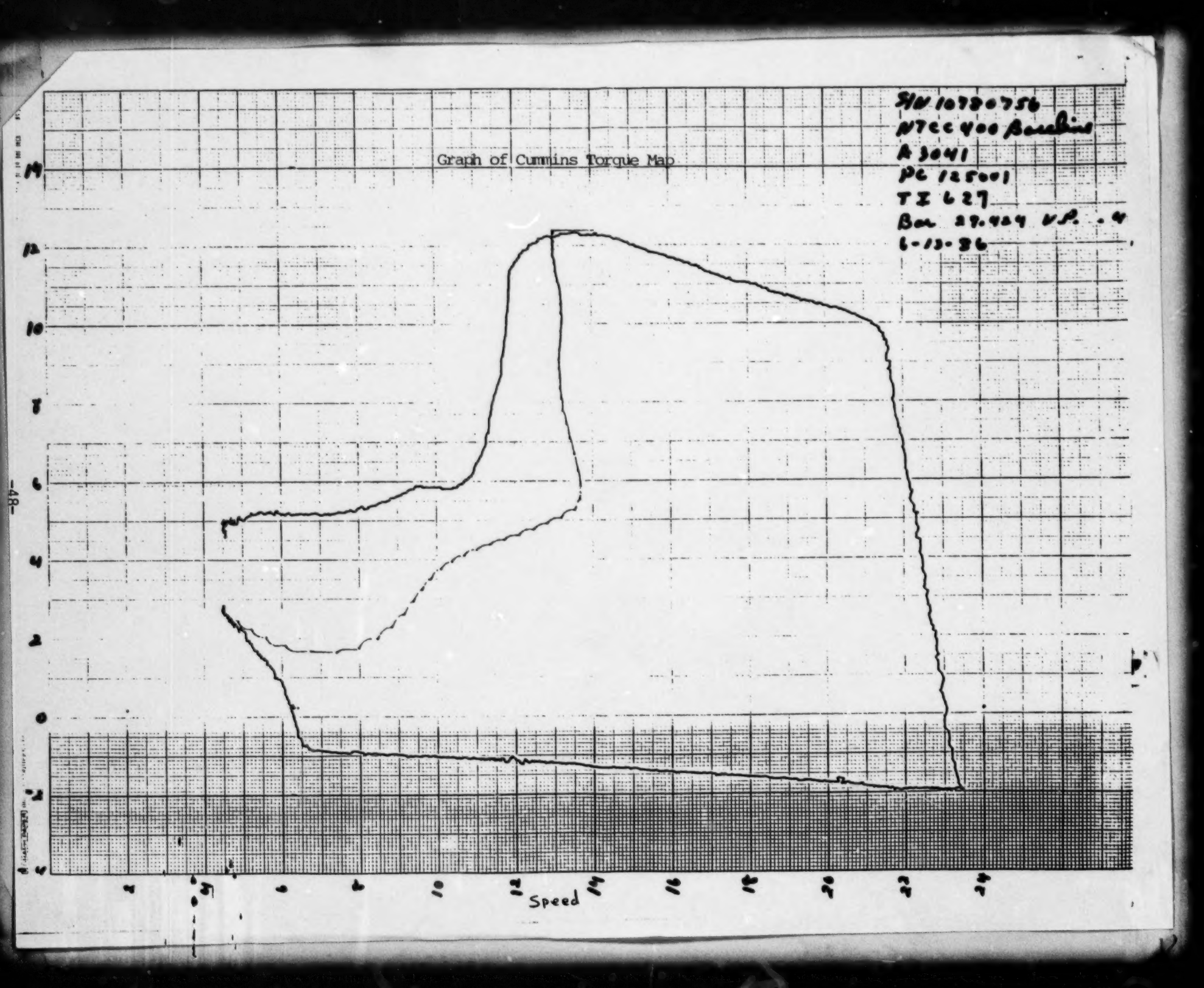
Graph of Cummins Torque Map
SN 10780756
NTEC 400 Baseline
A 3041
PC 125001
TI 627
Bm 29.424 VP. .4
6-13-86
Speed

Mr. Tom Baines, EPA
Ann Arbor

A 3041
PG 12 5001
TC 304
6-13-86

Cummins
Torque
Map

07/01/86 08:43 TECH. CENTER 5TH NO. 001 001

TRANSIENT EMISSION CYCLE

ENGINE SERIAL NUMBER 10780756

IDLE SPEED	=	627.0
RATED SPEED	=	2100.0
EPA RATED SPEED	=	2100.0
DYNO TYPE CODE	=	0
PUMP TYPE CODE	=	0
DYNO INERTIA	=	200.0
DYNO ZERO	=	0.0
DYNO SPAN	=	-1250.0
DYNO PREDICTION GAIN	=	1.00
THROTTLE PREDICTION GAIN	=	0.80
MAXIMUM TORQUE	=	1229.29
RATED HORSEPOWER	=	402.78
MAXIMUM HORSEPOWER	=	405.17
AT SPEED	=	2066.0
WITH CALCULATED TORQUE	=	1030.0

ENGINE TORQUE CURVE

SPEED	WIDE OPEN	CLOSED
677.0	516.7	-67.9
777.0	523.4	-92.2
877.0	555.0	-97.3
977.0	583.0	-102.0
1077.0	607.7	-108.0
1177.0	1025.0	-109.4
1277.0	1221.0	-119.7
1377.0	1229.3	-128.0
1477.0	1211.4	-132.4
1577.0	1177.2	-140.5
1677.0	1138.7	-147.7
1777.0	1104.8	-152.3
1877.0	1075.7	-161.3
1977.0	1050.5	-168.9
2077.0	1023.9	-177.9
2177.0	791.6	-184.7
2277.0	172.0	-192.3
2377.0	-355.6	-195.2

FROM: SHIRISH SHIMPI
CUMMINS